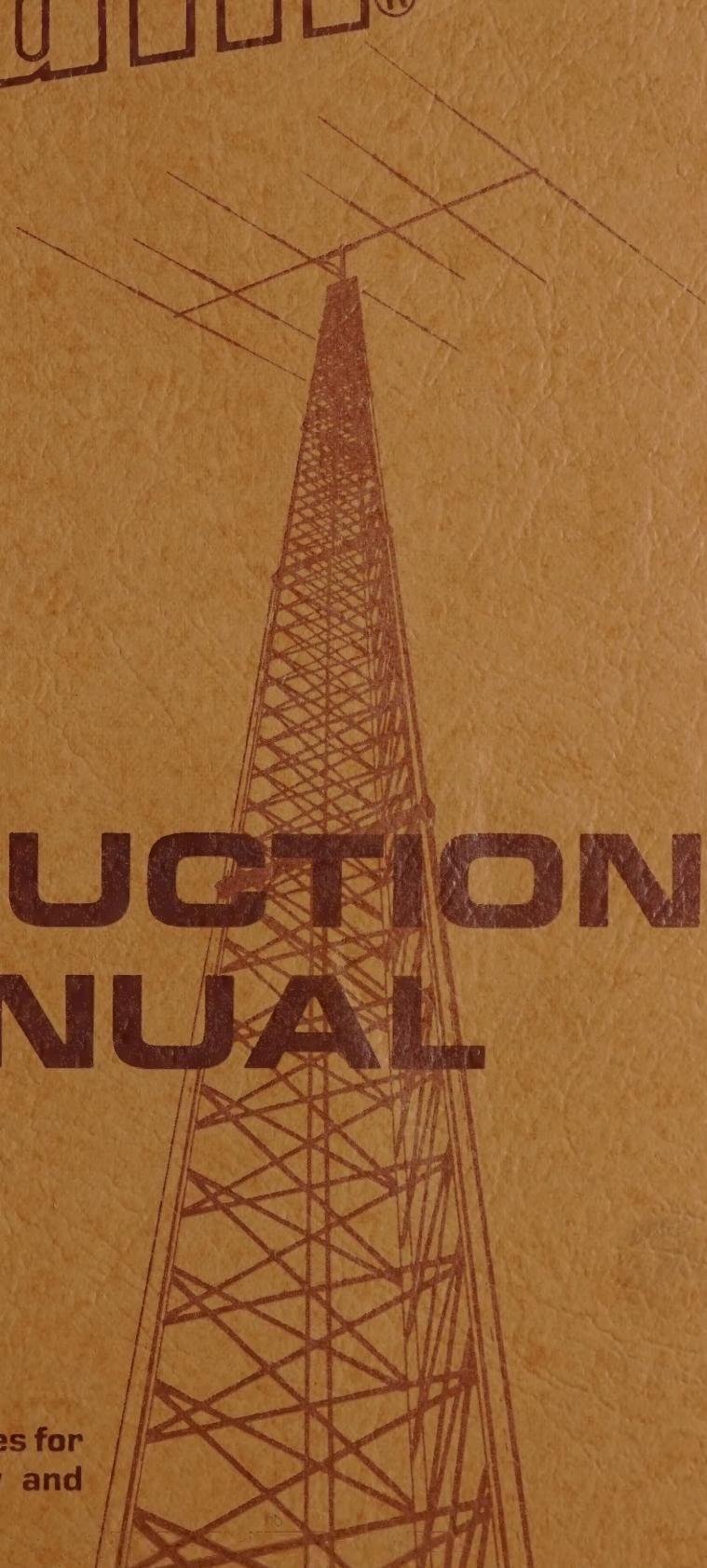


85092

hy-gain®

INSTRUCTION MANUAL

Antennas, Towers and Accessories for
Commercial, Industrial, Military and
Private use.



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CD-45-II ROTATOR SYSTEM

ORDER 302 — 120 VAC
NO. 302-2 — 220 VAC

OWNER'S MANUAL

NOTICE

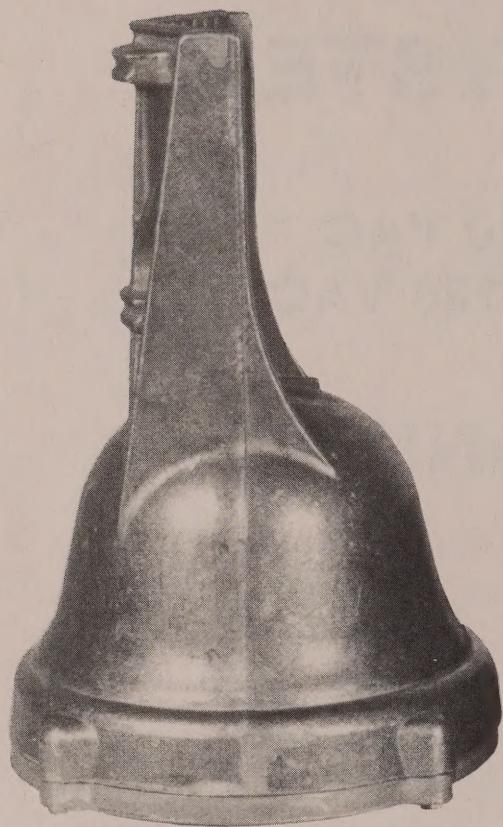
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TELEX *hy-gain*[®]

TELEX COMMUNICATIONS, INC.

9600 Aldrich Ave. So., Minneapolis, MN 55420 U.S.A.

AA-0302-A-002



THE CD-45-II IS RECOMMENDED FOR MEDIUM SIZE COMMUNICATION ANTENNAS. FOR LARGER ANTENNAS, THE HAM IV OR T²X HEAVY-DUTY ROTATORS ARE RECOMMENDED.

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CHAPTER 1

INSTALLATION AND OPERATION

Section I. Components of the CD-45-II

General Description

The CD-45-II Rotator consists of a bell type rotator, a metered control unit and the necessary mounting hardware. The rotator is designed to mount on a plate inside a tower or on a mast. The rotator unit must be wired to the control unit with a 7 or 8 wire cable. The control unit must be placed inside the house or another protected location.

Included in the Rotator box are the following:

- A. Owner's Manual, PN 801930-2
- B. Rotator, PN 51571-10
- C. Mounting Hardware Kit, PN 50425-10
- D. Control Unit, PN 51568-10

Due to the wide variety of towers available, each installation will have different requirements. The gauge of the cable to connect the control unit to the rotator depends upon the distance between the rotator and control. The longer the distance the larger the diameter of the wire required. Various antennas or beams require different installation methods. For this reason, the owner must procure the remainder of the components after checking their compatibility. In general, these will be:

- A. The beam or antenna desired and a suitable antenna mast.
- B. A tower or other mechanism to position the rotator and beam for safe and effective rotation (see **CAUTIONS**).
- C. 7-wire cable to connect the control to the rotator (see Section V).
- D. Coaxial cable to connect the beam to the communications equipment.
- E. Appropriate guy wires as required.
- F. Ground Hardware.

Section II. Specifications

Specifications

Input Voltage	120 VAC 50/60 Hz
Optional	220 VAC 50/60 Hz
Motor	24 VAC, 2.25 Amp, split phase
Power Transformer ...	120 VAC/26 VAC 10% duty, thermal switch protected
Optional	220 VAC/26 VAC 10% duty, thermal switch protected
Meter Transformer	120 VAC/13 VAC continuous duty
Optional	220 VAC/13 VAC continuous duty
Meter	DC voltmeter 1000 ohms/volts, 1 MA full scale
Meter Scale	Direct Reading: North centered, 5° increments
Optional	Direct Reading: South centered, 5° increments

Specifications (Cont.)

Maximum Antenna Size:

A. Tower Mounted as per Figure 3	8.5 square feet (.79 sq. m) of wind surface area
B. Outside Tower or Mast Mounted as per Figure 5 or 7	5.0 square feet (.46 sq. m) of wind surface area
Maximum Interconnect Cable Resistance:	
A. Terminal 1	1.0 ohms
B. Terminals 3, 4, 5, 6, 7, & 8	2.5 ohms
Rotation Time	45-60 seconds with 60 Hz input
Brake	automatic disc type
Rotator Size	8 inches (20 cm) maximum diameter by 17 $\frac{3}{8}$ " inches (44 cm) high
Maximum Antenna Mast Size	2 $\frac{1}{16}$ " O.D. (52 mm)
Mounting Hardware	plated steel hardware and plated steel clamps
Control Unit Size	8.5 inches (21.6 cm) wide x 9.0 inches (22.8 cm) deep x 4.3 inches (11.0 cm) high
Shipping Volume	2411.02 cubic inches (0.0395 cu. m)
Shipping Weight	22.0 pounds (9.98 kg)

Section III. Cautions

Cautions

- A. Install properly and safely.
- B. Towers, often the highest metal parts in the vicinity, require extreme caution during erection and placement. Extreme care must be taken during erection so that metal towers and beams do not contact power lines even if the beams slip or rotate, towers fall or fracture or metal wires blow in the wind, etc..
- C. Metal towers or other position mechanisms must be placed so that if they fracture or blow over in high winds, they cannot contact power lines, be a hazard to individuals, or endanger property.
- D. When not mounted within a tower with a thrust bearing as shown in Figure 3, the rotator must be *derated*.
- E. Metal towers must be grounded properly at the tower location before the tower is erected. This is to minimize electrical hazard and the possibility of lightning damage. Do not bury bare aluminum wires or stakes in the ground. Use copper ground stakes. The service entrance ground should be checked. The household convenience outlet should be the 3-prong type (grounded back to the service entrance).
- F. The Control Box is not weatherproof and must be located in the house, ham shack or other protected location.
- G. Read this manual thoroughly before proceeding.

The CD-45-II Rotator has been carefully designed and manufactured to give many years of trouble-free service when carefully and professionally installed. It consists of the strongest and best commercially available components.

Section IV. Installation Information

Types of Installations

There are three general types of installations (see Figures 3, 5 and 7).

1. The recommended installation is an "Inside" Tower Mount, as shown in Figure 3, with a top bushing or bearing to provide lateral support and resist high wind loads.

When the rotator is properly mounted this way, it can be rotated to turn an antenna or beam of 8.5 square feet wind surface area. The wind loading during storms, the rotational inertia of the beam, and unbalanced weight are more important than the dead weight of the beam. It is important to minimize the height of the beam above the rotator to minimize the overturning force induced in a high wind (see "Unbalanced Weight" and "Wind Pressure").

2. An "Outside" Tower Mount, as per Figure 7, is the best type of installation when not using an inside tower mount. The rotator is not as well protected but the installation is simpler.
3. A telescoping or other type mast, as shown in Figure 5, can also be used. The lower mast support is required for this installation.

There are variations of mounting falling generally into one of the above categories. For example, the rotator may be mounted lower in the tower than shown in Figure 3. In that case, more than one bushing or thrust bearing for the beam mast may be required and longer coast down time allowed in operation. These factors are interrelated and the components must be matched together.

Unbalanced Weight and Wind Pressure

1. **Unbalanced Weight:** Weight should be as closely balanced as possible. Unbalanced weight creates a bending moment of force which is concentrated on the mast at the point where it is clamped to the rotator.

This moment tends to strain the mast at that point and also to bind the ball bearings by creating excessive downward pressure on one side and upward pressure on the other. Such unbalance places additional stress on the motor and gear train. Unbalanced weight becomes critical as the distance from the antenna boom to the clamping point at the rotator is increased.

2. **Wind Pressure:** Wind pressure against the boom and elements produces a bending force on the mast which can cause the same stresses as unbalanced weight. To strengthen the installation to withstand unbalanced weight and wind pressure the top mast should be as short and as strong as possible. In multiple arrays the heaviest should be closest to the rotator. In order to distribute the bending stress and prevent fracture of the mast, the CD-45-II Rotator includes two specially designed steel clamps to secure the mast to the rotator.

After procuring the type of tower or other positioning mechanism of the owner's choice, the next step is to wire the rotator to the control box and check out its operation prior to installation.

Section V. Wiring and Check-Out

Wiring and Check-Out

A preliminary operation check should be made prior to installation. We recommend the following procedure:

NOTE: The CD-45-II requires only 7 wires to operate properly since Terminal 2 in the rotator is unterminated. However, if an 8-wire cable is used, the Ham IV Rotator can be installed at a later time without changing the cable or control.

If the Hy-Gain Ham IV is required, due to a larger antenna being installed, it will only be necessary to purchase the Ham IV Rotator, Part Number 51569-10. The control units and cable requirements are identical, therefore, only the installation of the heavier duty rotator will be necessary.

- A. Decide the wire gauge (size) required and procure the number of feet of the proper cable (see Table 1).

<u>Maximum Length</u>	<u>Gauge for Terminals 1 & 2</u>	<u>Gauge for Terminals 3-8</u>
125' (38 m)	#18 (1.19 mm)	#22 (.76 mm)
200' (61 m)	#16 (1.42 mm)	#20 (.97 mm)
300' (91 m)	#14 (1.75 mm)	#18 (1.19 mm)
500' (152 m)	#12 (2.12 mm)	#16 (1.42 mm)
800' (244 m)	#10 (2.95 mm)	#14 (1.75 mm)

Table 1

- B. Strip and tin 3/8" on both ends after removing about 4 inches of the jacket. Tinning can be accomplished, after twisting the strands together, with an ordinary soldering iron and radio solder, being careful not to melt the insulation.
- C. With the Control Unit and the Rotator on the work table, connect the cable between the Rotator and Control Unit using the full length of cable that will be used in the installation. *It is important that Terminal #1 on the Rotator is connected to Terminal #1 on the Control Unit and so on.*

NOTE: The specifications call for heavier gauge wire on Terminal #1. Lead #1 must be heavier gauge and less total lead resistance (see Specifications, page 1). Wire the control to the rotator as shown in Figures 1 and 2.

CAUTION

Shorts between terminals or grounded leads may damage the rotator.

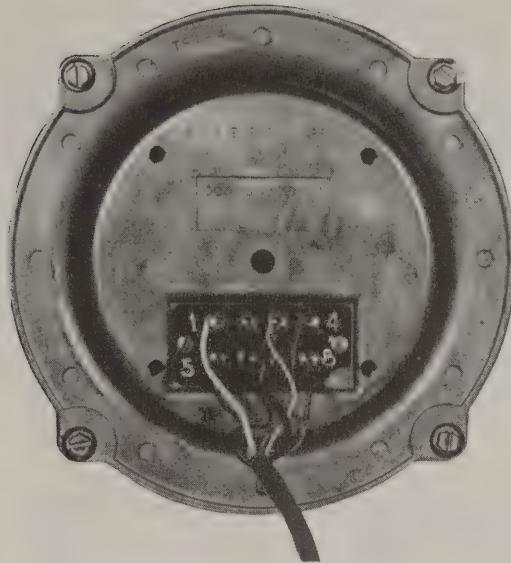


Figure 1
Rotator Wiring (Base)

- D. Install four (4) $1\frac{1}{4}$ "-20 x $1\frac{1}{4}$ " bolts in the four mounting holes in the bottom of the bell housing. Run them in about a $\frac{1}{2}$ " and leave them as close to equal length as possible.
- E. With the rotator sitting in the upright position, resting on the four (4) $1\frac{1}{4}$ "-20 x $1\frac{1}{4}$ " bolt heads and connected to the control unit by the cable, plug the power cord into a 120 VAC 50/60 Hz or 220 VAC 50/60 Hz wall socket, depending on which unit you have.
- F. Turn the power switch on. The meter should be illuminated.
- G. Depress the "Brake Release" (Center) lever, hold it, and simultaneously depress the CCW direction switch (Left). The rotator should turn CCW (looking from the top). This is S-E-N-W-S. Release the CCW direction switch; the rotator will coast down and stop. Now release the brake switch. The rotator is now locked into position.
- H. Repeat Step G for CW direction by depressing the brake switch first, then the CW direction switch (Right).

CAUTION

It is best to release the direction switch just prior to the end of rotation (extreme CW or CCW position) in order not to cause undue stress on the stop arm and/or the gears.

- I. Return the rotator to full CW position.

FOR CUSTOMER'S USE

ENTER THE NUMBER/COLOR OF EACH LEAD
CONNECTED TO THE TERMINALS.

1	2	3	4
Blu Wht	02 Lyo	00 Wht	Blu Wht
5 SW	6 WS	7 BLK	8 RB

AA - 0302 - A - 004

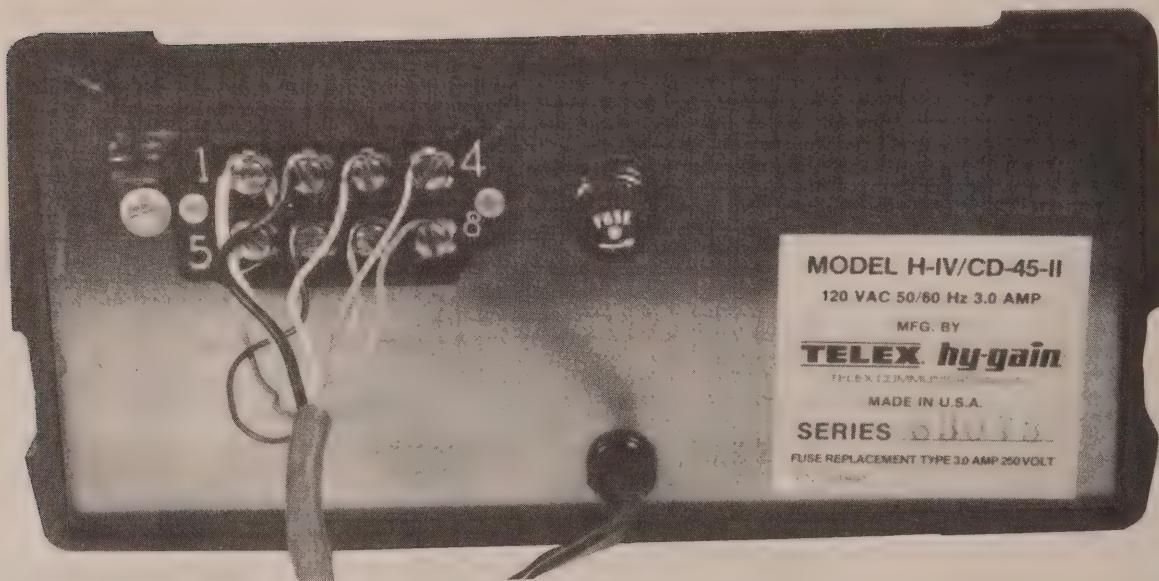


Figure 2
Control Unit Wiring (Rear Panel)

Section VI. Mounting the Rotator

Inside Tower

CAUTION

The rotator is designed for vertical operation with the bell shaped housing in the up position. Water and other contamination will get into the motor unit if it is mounted horizontally, at any angle, or upside down.

The rotator is mounted inside a tower (see Figure 3) to the flat tower plate by means of four (4) bolts furnished in the hardware kit. Use the following procedure:

1. Locate the rotator in the tower directly under the bushing. Note that the tower plate must be cut out to allow the connecting cable to pass through the plate.
2. Reattach the wires in the same manner as used in the trial assembly and secure the wires to the tower in such a manner that the wires will not be strained.
3. The rotator is attached to the tower plate by means of four (4) bolts and lockwashers (see Figure 4). Spacer washers must be used between the rotator and plate for clearance of the rotator housing bolt heads. The flat tower plate must be drilled in four (4) places using the template provided with this manual unless the tower plate is already properly drilled. A fifth hole must be drilled or cut to clear the control cable.
4. Tighten the four (4) bolts, but not to final tightness. Observe how the rotator turns. It must rotate in such a manner as to turn the mast concentrically to the top bushing.
5. Trial assemble the mast to the top of the rotator using the U-bolts, nuts and lockwashers through the rotator and clamps as shown in Figure 4. The maximum mast diameter that may be used is $2\frac{1}{16}$ " O.D.. We recommend $1\frac{1}{2}$ " nominal steel pipe with 1.9" O.D. in standard wall thickness of .145". For stacked arrays or very large beams, we recommend extra heavy-duty wall thickness .200". Both steel pipes can be purchased to specification ASTM-120.

On any inside tower installation, care must be exercised to get the antenna mast shimmed to the exact rotational center of the rotator. The geometry is such that a mast of 2.062" ($2\frac{1}{16}$ ") (52 mm) O.D. pipe will be exactly centered. If the O.D. of your mast is less than this, you should shim out to these dimensions. For each .0625" (1/16") (1.6 mm) less mast diameter used, .031" (1/32") (.8 mm) of shim stock must be wrapped around the mast at the clamping points. Put differently, subtract your mast diameter from $2\frac{1}{16}$ " and divide the difference by 2.

Example 1

Proper O.D.	=	2.062"	
Your O.D.	=	<u>1.900"</u>	(Nominal 1½" pipe has O.D. of 1.9")
Difference	=	.162"	
Shim To Use	=	.081"	(.162" ÷ 2 = .081)

Example 2

Proper O.D.	=	2-1/16"	
Your O.D.	=	<u>2</u>	
Difference	=	<u>1/16"</u>	
Shim To Use	=	1/32" or .031"	(1/16" ÷ 2 = 1/32")

Example 3

Proper O.D.	=	2-1/16"	
Your O.D.	=	<u>1-3/4"</u>	
Difference	=	<u>5/16"</u>	
Shim To Use	=	5/32" or .156"	(5/16" ÷ 2 = 5/32")

Example 4

Proper O.D.	=	52 mm	
Your O.D.	=	<u>48 mm</u>	
Difference	=	<u>4 mm</u>	
Shim To Use	=	2 mm	(4 mm ÷ 2 = 2 mm)

6. If the rotator, top bushing and mast are properly aligned, there should be unrestricted rotation through 360°. If not, the rotator may have to be moved slightly on the flat plate. If a high quality bearing is used in the top of the tower (recommended), the shimming procedure must be done more carefully as closer tolerances are required. ***It is important that the rotator does not try to turn the mast eccentrically with the top bushing or bearing.***
7. Tighten the four (4) bolts carefully—to approximately 100 inch-pounds of torque.
8. Return the rotator to the full CW "S" position. Mount the beam pointing South. The coaxial cable should be looped as per Figure 3, in such a manner that it will not foul or tangle when the beam turns around in a circle to the full 360° counterclockwise position. (The antenna rotates "S" "E" [counterclockwise] on the first turn, therefore, slack should wrap counterclockwise around the mast.) Tighten the U-Bolts securely.

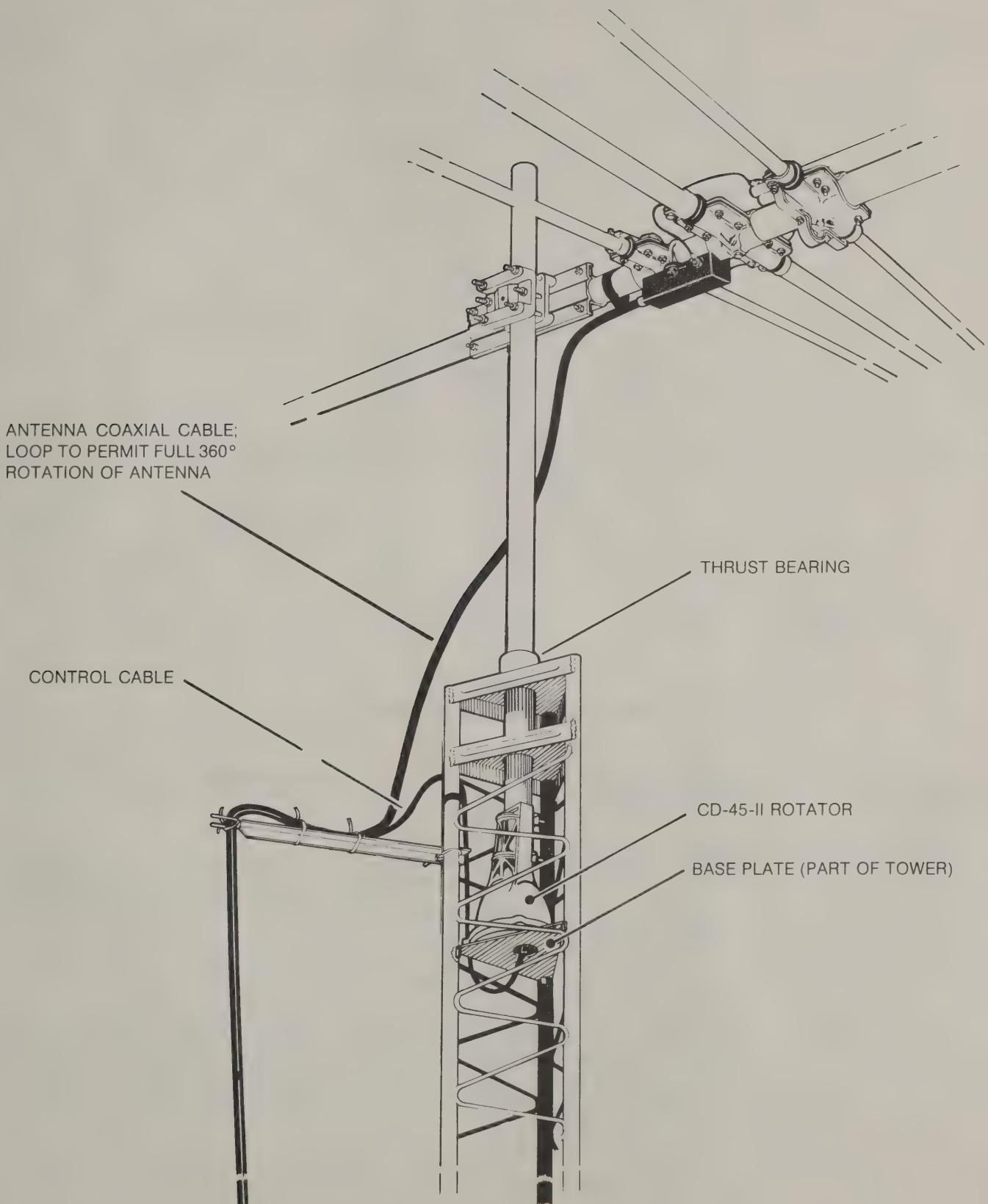


Figure 3
Rotator Mounted Inside Tower

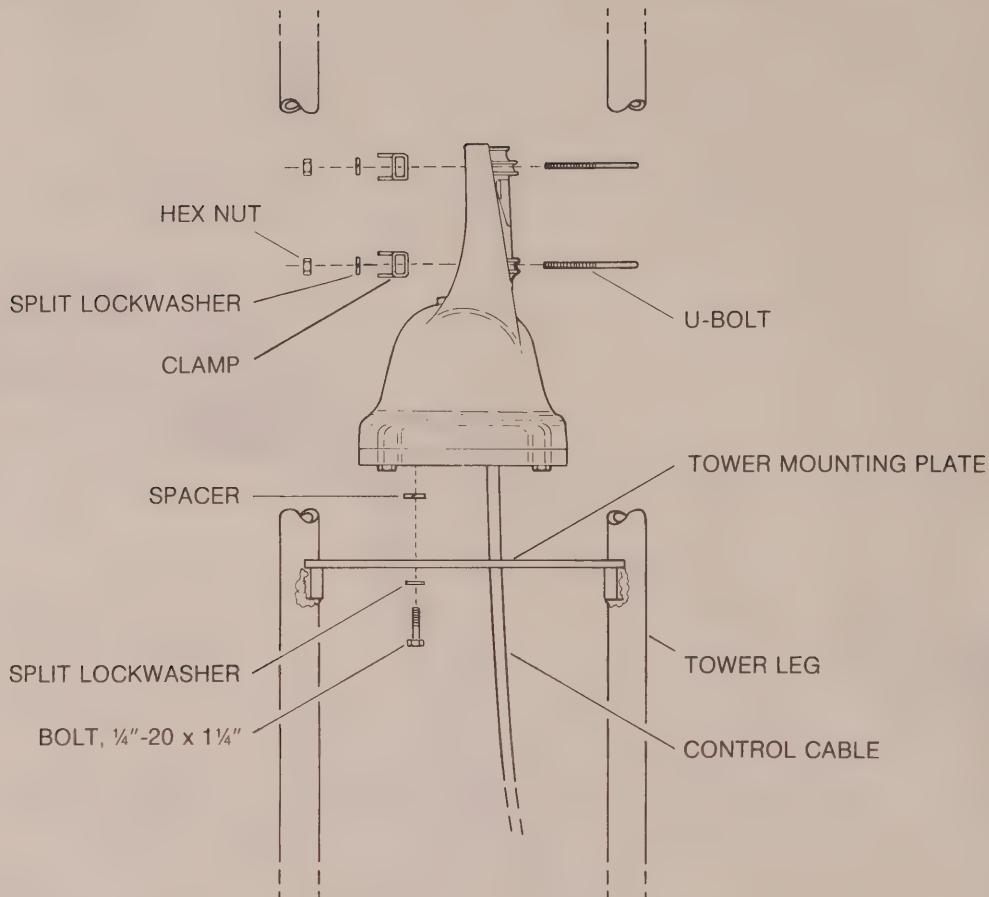


Figure 4
Rotator Mounting in a Tower

Mast Mounting

1. Mount the rotator to the lower mast support and then attach the support to the mast. (See Figures 5 & 6.)
2. Attach one end of the control cable to the rotator terminals. Use the same sequence as used on the pre-installation check. The cover and grommet must be slipped over the cable prior to attaching it to the terminals on the rotator. (See Figure 6.)
3. Tape the rotator control cable to the mast at points 18" to 24" apart.
4. Connect the antenna cable to the antenna (follow manufacturer's recommendation). Make sure you have enough slack for the 360° rotation. (The antenna rotates "S" to "E" [counterclockwise] during its first turn, therefore, slack should wrap counterclockwise around the mast.) See Figure 5.
5. Attach the mast guy wires to the rotator lower mast support or mast ring.
6. Raise the mast into position. Rotate the mast by hand until the antenna receiving end is pointing in a southerly direction. Tighten the base clamp. Line up the mast in the vertical position and tighten the guy wires.

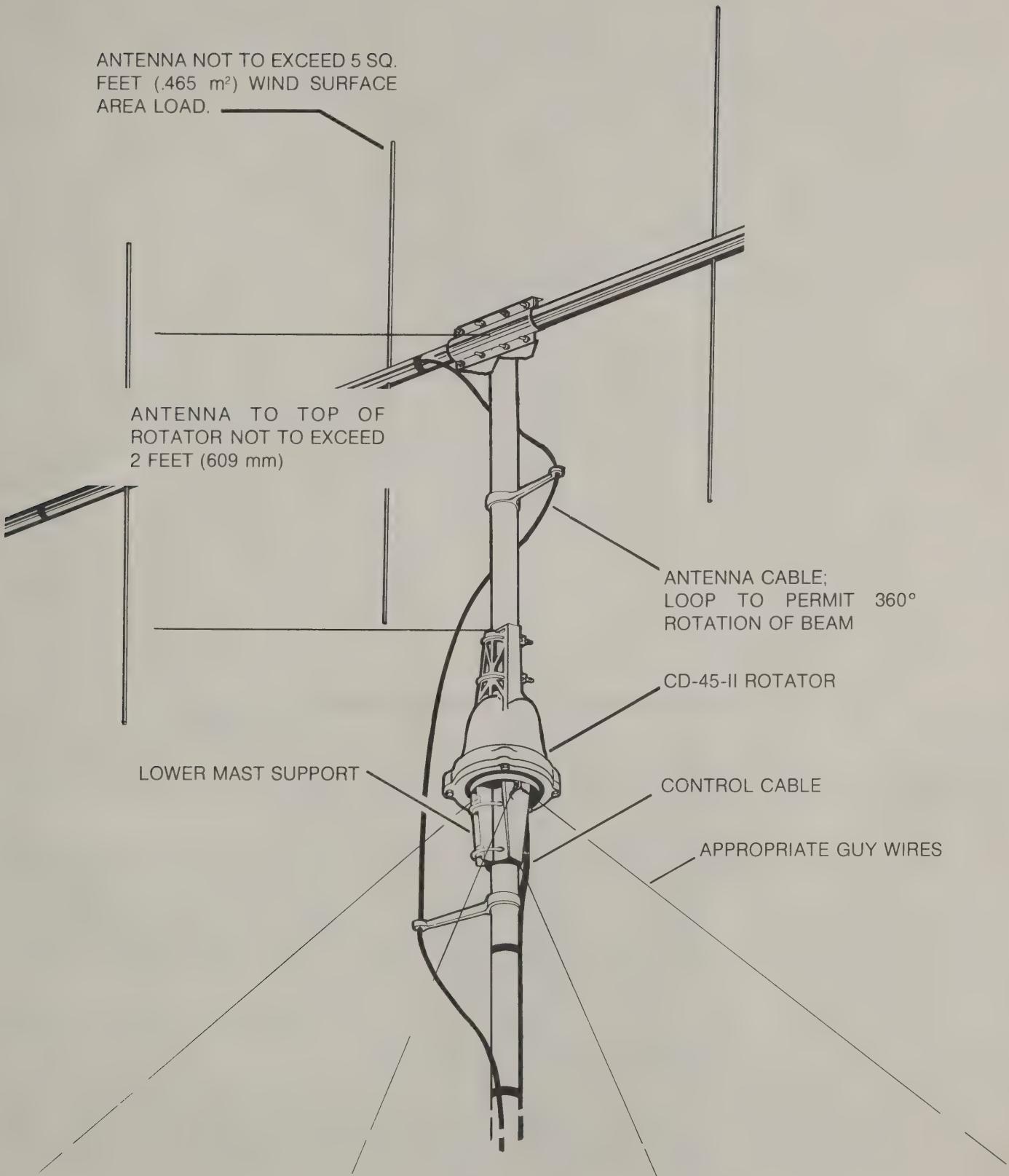


Figure 5
Mast Mounted Rotator

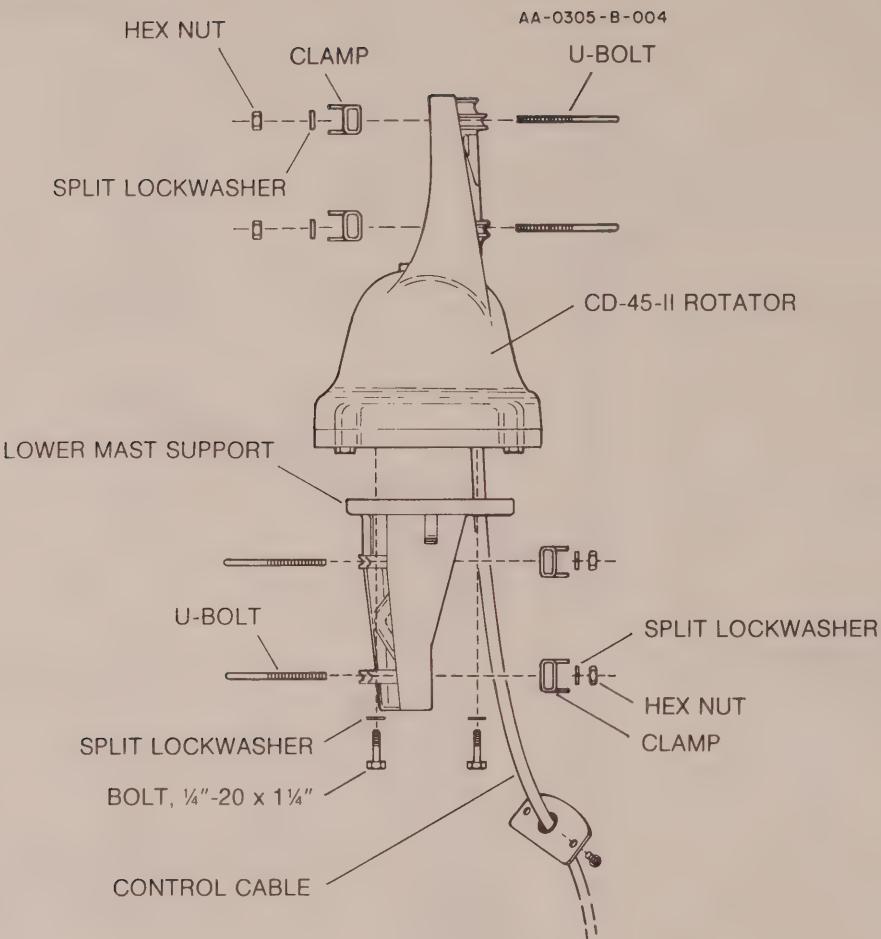


Figure 6
Rotator Mounting with Lower Mast Support

**Top of Tower
 Installation**

1. Mounting the rotator on top of a tower is similar to the mast mounting except the lower mast support is not used. (See Figure 7.)
2. The rotator is attached to the tower plate by means of four (4) bolts and lockwashers (see Figure 8). Spacer washers must be used between the rotator and plate for clearance of the rotator housing bolt heads. The flat tower plate must be drilled in four (4) places using the template provided with this manual unless the tower plate is already properly drilled. A fifth hole must be drilled or cut to clear the control cable.
3. Connect the control cable to the rotator after passing it through the tower plate. Tighten the mounting bolts securely.
4. Assemble the mast and antenna to the top of the rotator using the U-bolts, nuts and lockwashers through the rotator and clamps as shown in Figure 8. The maximum mast diameter that may be used is $2\frac{1}{16}$ " O.D.. Turn the antenna by hand until it points South then tighten the U-bolts securely.
5. Tape the rotator control cable to the tower at points 18" to 24" apart.

ANTENNA NOT TO EXCEED
5 SQ. FT. (0.465 m²) WIND
SURFACE AREA LOAD

ANTENNA ON TOP OF
ROTATOR NOT TO EXCEED
2 FEET (609mm)

ANTENNA CABLE;
LOOP TO PERMIT 360°
ROTATION OF BEAM

CD-45 ROTATOR

CONTROL CABLE

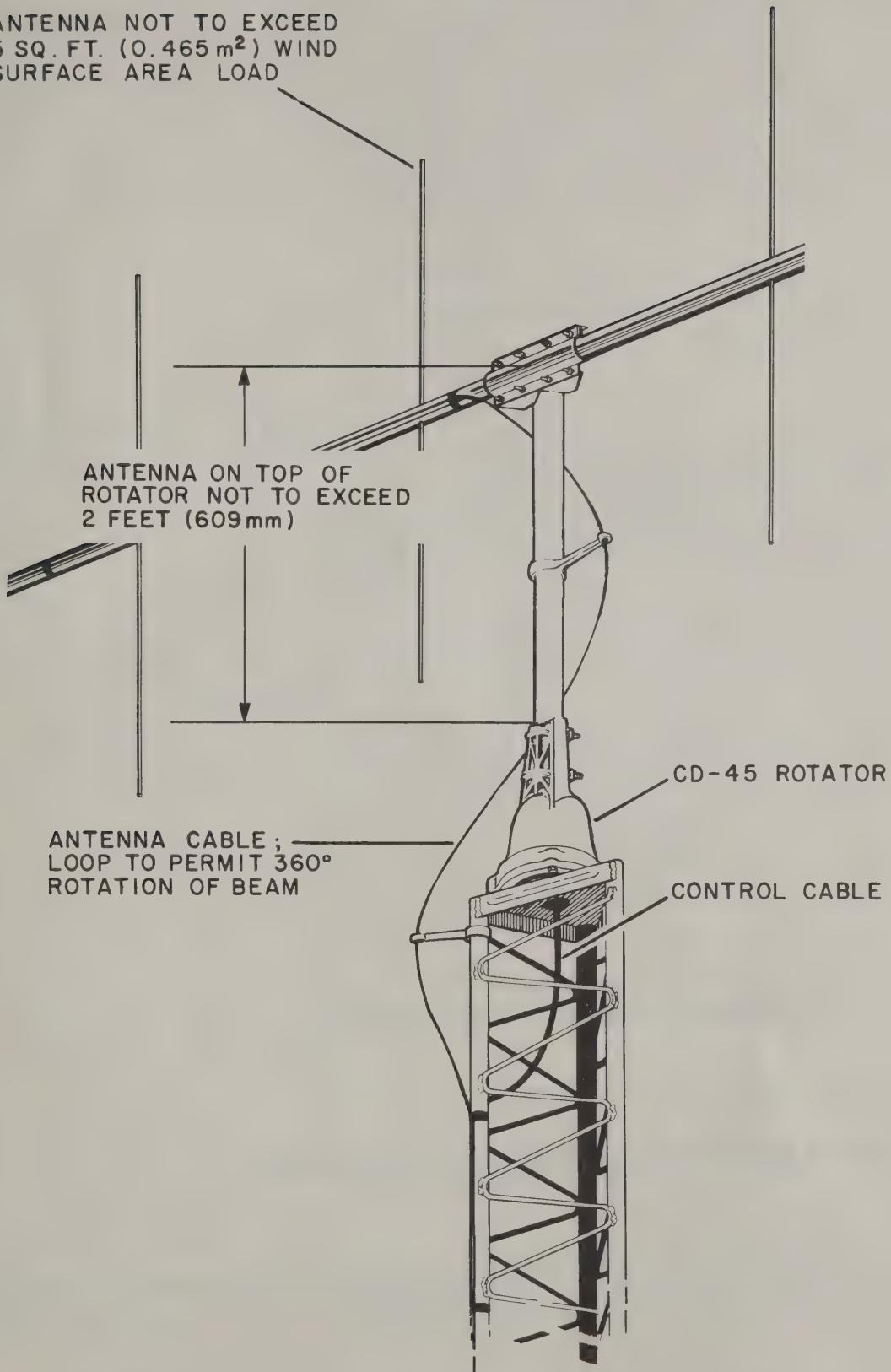


Figure 7
Rotator Mounted on Tower Top Plate

6. Connect the antenna cable to the antenna (follow manufacturer's recommendation). Make sure you have enough slack for the 360° rotation. (The antenna rotates "S" to "E" [counterclockwise] on the first turn, therefore, slack should wrap counterclockwise around the mast.) See Figure 7.

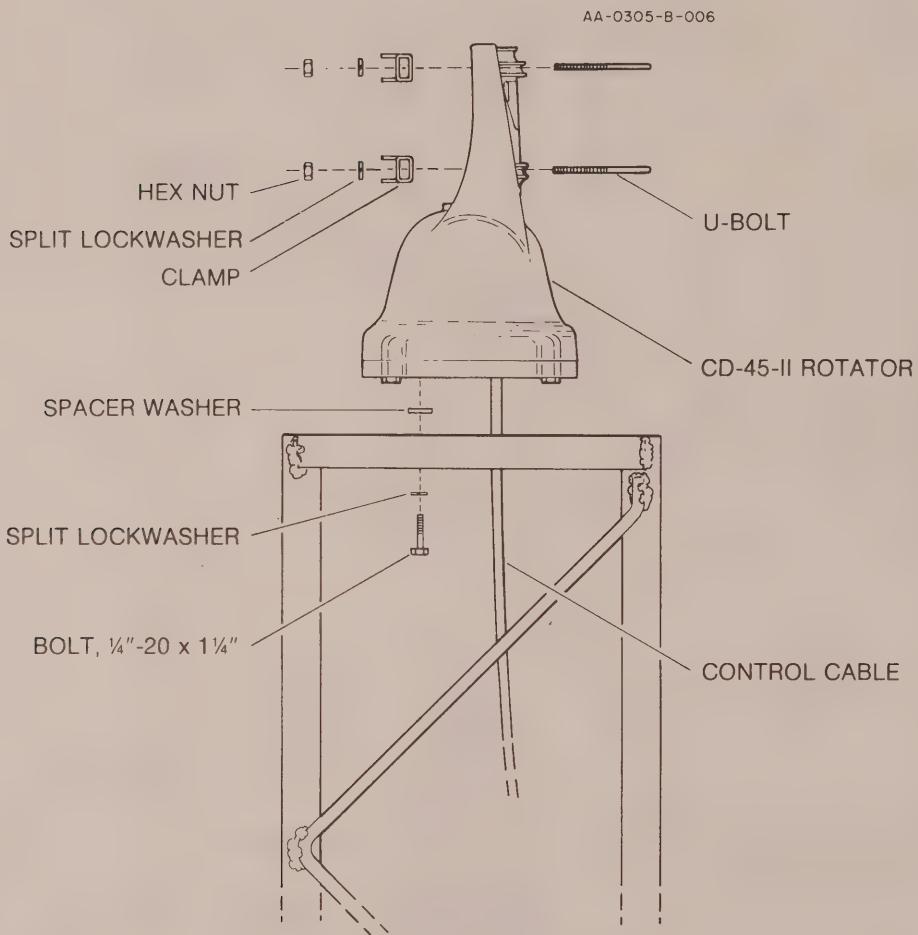


Figure 8
Rotator Mounting on a Tower Top Plate

Section VII. Thrust Bearing with Sleeve (121B)

General

Product 121B is a thrust bearing that utilizes a bronze/oil bearing. It will clear up to a $2\frac{3}{16}$ " diameter mast. It can be bolted to all Hy-Gain crank-up towers when the rotator is mounted inside the tower.

Section VIII. Tower Mounting/Spacing Kit (50559-10)

General

The Tower Mounting/Spacing Kit is a flat plate equipped with four (4) 0.5 inch standard bushings drilled to match the hold-down screw holes in the bottom of a Hy-Gain bell type rotator. The plate is designed to allow enough clearance under the bottom of the rotator to clear the rotator housing bolt heads and control cable.

Section IX. Operation

Preliminary Check and Calibration

NOTE:

THERMAL PROTECTION: If the rotator fails to turn after 4 or 5 minutes of continuous operation, the thermal switch has come into play. This protective device in the transformer automatically shuts off power if the rotator is used continuously for too long. It will automatically reset after 10 minutes.

1. Turn the Control Unit Power "ON" with the upper right "On-Off" switch. The meter should be illuminated and the needle should be to the right.
2. Depress the brake lever (center) and hold. Depress the CCW lever (left) and operate the rotator to its full CCW position. Observe the antenna cable on the first rotation to insure it does not get fouled. If the meter does not move from the right to the left hand position, press and release the "Calibrate" switch.
3. With the rotator in its full CCW position, if the meter is not at its full left position, carefully adjust the zero (CCW South) position with the screw directly under the meter to exactly South.
4. **Meter Calibration** of the extreme full scale (right hand or clockwise South) can be accomplished at any time without disturbing the rotator using the following procedure:
 - a. With the Control Unit "ON", push in and release the "Calibrate" knob.
 - b. The meter should now indicate full scale to the right. If it does not, turn the calibrate knob until it does.
 - c. Without turning the knob, push it in and release it. The right scale is now fully calibrated to adjust for minor variations in components values. **Do not turn the knob**, even in the "push-off" position because to do so will require that it again be recalibrated.
5. Return rotator to its full CW end of rotation.

When the control unit is turned "Off", the meter needle will fall to the left "S" position and return to indicate the rotator position as soon as the control unit is turned "On" again. It will not damage the unit to leave it turned "On" for extended periods.

Section X. Grounding

General

The tower, or other metal support device, must be grounded to an *earth* ground at its location. Use heavy copper cable looped so that if the tower comes down for any reason, there will be adequate slack to prevent the ground wire from breaking. Use one or more 8 foot copper jacked steel stakes driven into the moist earth and fasten the wire securely at the stake and at the tower.

As mentioned in the “**Cautions**” portion, the steel chassis of the control box should be either grounded to a metal cold water pipe in the house or back to the electric service entrance box where the power comes into the house. This normally is accomplished with the wire of the 3-prong plug which then depends on the wall outlet being adequately grounded back to the service entrance as well as to the utility ground. If there is any doubt, have this checked by a licensed electrician.

Section XI. South Centered Meter Scale Conversion

General

The stock CD-45-II Control Unit is shipped with the meter scale installed for “North” center operation; ends of rotation are at the “South” position. Some geographic locations and/or popular working areas may favor having the meter “South” center; ends of rotation are at the “North” position. We have provided the CD-45-II with a reversible meter scale.

We recommend the following procedure:

1. Disconnect the power cord.
2. Remove the control cable, carefully labeling each wire with its corresponding terminal number. This operation may be omitted if the control box can be worked on easily without removing the leads.
3. Remove the top and bottom covers.
4. Slip the lamp and holder off the lamp holder bracket. Loosen the hex nut on the transformer that is holding the lamp holder bracket and swing the bracket clear of the wires leading to the printed circuit board.
5. Carefully remove the hex nuts on the meter studs to free the printed circuit board. Slip the P.C. Board off the studs and pull it down under the chassis.

CAUTION

It is good practice to use a short test lead or jumper wire to short the meter studs when it is not in the circuit.

6. Loosen the meter retaining clips and remove the meter from the chassis.

7. Insert a small pen knife between the clear meter cover and black housing at either corner of the top edge and gently pry the cover loose from that corner. Repeat for the other corner. The meter cover should pop off.
8. Carefully slip a pen knife under each corner of the lower edge of the white meter scale and twist slightly until the scale clears the two small indexing pins. Remove the scale, turn it over, and reinstall it. Make sure the scale fits over the indexing pins and that it is flush and tight against the black housing. This will assure free movement of the indicator needle.
9. Reinstall the meter (remove the temporary jumper), the P.C. Board and lamp hardware. Check for pinched, shorted and/or overstressed wires.
10. Reinstall the top and bottom covers.
11. Reconnect the control cable in the exact sequence as they were removed.

If your beam was installed originally using the Ham IV with a "North" center scale, the antenna mast must be loosened and repositioned. In order for the meter to indicate properly, the front of your beam must point "North" when the rotator is at the ends of rotation.

Recalibrate the meter.

CHAPTER 2

CONSTRUCTION AND SERVICING

Section I. Control Unit

(Refer to Figure 12)

General Description

1. **Power:** The On/Off switch is a toggle type. The unit is protected by a 3 amp line fuse which is located in a fuse holder on the back panel. The power transformer supplies power for the rotator motor. The transformer is protected by a thermal cut-out switch located in the primary. If the cut-out switch opens, turn the unit off and wait 10-15 minutes before resuming operation.
2. **Meter Circuit:** The position indicator meter and its circuitry is powered by the meter transformer. When the power switch is "on", the meter is illuminated and continually indicates rotator position. Stability is assured by the 13 volt zener regulated power supply. The meter circuit is protected by the 1/8 amp fuse.
3. **Calibration:** The calibration switch is a push-on/push-off, turn-to-adjust type. It calibrates the right hand position (full scale) of the meter.
4. **Rotator Control:** Counterclockwise rotation is controlled by the left hand lever and CW rotation by the right hand lever. The center lever is the brake release.

Section II. Rotator

(Refer to Figures 13 and 14)

General Description

1. **Outer Housing:** The upper mast support (Bell) and the brake housing are cast aluminum. The upper mast support is secured to the brake housing by four (4) #12-24 x 3/4" self-tapping hex head screws.
2. **Position Sensor:** The position sensing potentiometer is located in the top of the bell casting.
3. **Drive:** A low voltage AC motor and its associated gears drive the output ring gear at about 1 RPM. The ring gear in turn is mechanically interlocked in the upper mast support (Bell).
4. **Brake:** The brake is a disc type which is an integral part of the motor armature. When power is applied to the motor, the armature lifts pulling the two disc pads apart which allows the gear train to operate freely. With no power applied, the weight of the motor armature forces the two brake pads together which in turn brakes the rotator.

5. **Rotation Limits:** Activated by the stop arm are two electrical end of rotation switches which disconnect the motor power just before the rotating bell housing reaches its full CW (0°) or CCW (360°) positions.
6. **Bearings:** Two rows of ball bearings are provided. Lubricate sparingly with factory approved special low temperature grease (PN 51497-10).

CAUTION

This unit has been thoroughly tested and cycled before shipment. Follow the terminal board wiring carefully between Rotator and Control Box. Incorrect wiring will burn out the rotator potentiometer and void the warranty.

Be sure Rotator and Control Units are compatible. Do not intermix models with different operating voltages. This results in sluggish or non-operating performance, burned out motors, overheated transformers and burned out rotator potentiometers, etc..

Section III. Troubleshooting

General

Most operational difficulties with rotators are traceable to broken, shorted or grounded wires usually at the terminal strips. Time spent in cutting the leads to exact lengths, tinning, forming and wrapping around terminals, cutting insulation to exact lengths, and clamping to prevent strain on any single wire, will pay dividends.

Mechanical Play

Frequently the slight motion of the antenna array in gusts of wind is due more to the natural flexing of the elements and mast than it is due to actual play in the rotator mechanism. A slight amount of "play" is built into the rotator to avoid binding due to environmental changes.

Antenna Rotates in Heavy Wind

This is usually a matter of the mast slipping in the support. If "slipping" or "turning" is suspected, return the rotator to the end of rotation and visually check to be sure that the antenna is in the original stop location as installed. Check the nuts on the U-bolts to insure that they are tight.

Lack of Power

If the antenna rotation is slow or sluggish or hard to start, check for proper voltages. If the voltages are correct, the 140 MFD motor start capacitor could be at fault. It is recommended that a new capacitor be tried before any other action is taken. If the electrical circuit is okay, then check for mechanical binding. Pay particular attention to bearings and alignment of the shaft on an inside tower mount. On any inside tower installation care must be exercised to get the top mast shimmed to the exact rotational center of the rotator upper mast support.

Improper Meter Indication

The brake and motor operate independently of the indicating system. If the pilot light burns at proper brilliancy, the instrument transformer is okay and the output is not shorted. Check the 1/8 amp meter circuit fuse with an ohmmeter. Check for about 13 VDC across Terminal No. 3 and No. 7 with the switch operated. If the proper voltage is not obtained, check the individual components in the meter circuit. If the 13 VDC is present, check for 500 ohms across rotator leads No. 3 and No. 7. If 500 ohms is present from No. 3 and No. 7, see if the readings from No. 3 to ground and No. 7 to ground total 500 ohms.

NOTE: If the needle remains in the right hand "S" position, check to be sure the calibration switch is not in the "calibrate" position. An intermittent condition in any component in the rectifier or meter circuits within the control box, as well as in the cable or potentiometer circuit in the rotator itself can cause meter fluctuation or error. Possible cause of such trouble may be localized by placing a test DC meter across Terminal No. 1 and No. 3 or No. 1 and No. 7 comparing the action of the test meter with the panel meter.

No Rotation—Indication OK

Either the thermal cut-out in the power transformer has opened or there is actually trouble in the motor circuit. After allowing time for the thermal cut-out to restore service, proceed to "Checking the Control Unit" and "Checking the Rotator from Ground".

Ground Wires

Grounds on cable leads can burn out either the line fuse or the small fuse in the meter circuit. If lead No. 3 or lead No. 7 is grounded, it shorts out part of the potentiometer so that as rotation progresses to the other end, the full DC voltage is applied across a decreasing portion until current becomes so high that the potentiometer burns out. Note also that any grounds may put an overload on the power transformer which could cause the line fuse to blow or overload the rectifier circuit so that the 1/8 amp fuse blows. For full explanations refer to Figure 9, Schematic.

Helpful Suggestions

Be sure to check your rotator cable for shorting, open circuits, incorrect wiring, intermittent connections, shorted terminals, poor lead dress at terminals, rodent damage, and mast support or thrust bearing binding.

Checking the Control Unit

1. Voltages with Unit Plugged In.

To check the control unit, plug the line cord into AC power. With no connections to the terminals turn the on-off switch to the "ON" position, the meter light will illuminate. The meter needle will remain on the left hand "S". Terminals 1 and 2 should show 30 volts AC (approximately) when the brake lever is depressed.

Terminals 1 and 5 should show 30 volts AC with brake release lever depressed and CW lever depressed.

Terminals 1 and 6 should show 30 volts AC with brake release lever depressed and CCW lever depressed.

Terminals 3 and 7 should show approximately 13 VDC.

2. Resistances with Unit Not Plugged In.

Disconnect the AC power source and remove the control cable. Be sure to tag each wire with the corresponding terminal number.

The control box can be checked without removing the cover by using a volt-ohmmeter to check values across terminals. Resistances across Terminals 1 thru 5 with clockwise switch lever (right hand) depressed and across Terminals 1 thru 6 with counterclockwise switch lever (left hand) depressed. Resistance across input line cord with on-off switch in the "ON" position and the brake lever depressed should read 3.8 ohms.

Checking the Rotator from the Ground

You may possibly avoid bringing the rotator down by making electrical checks from the control box position. This is done by disconnecting the 8 wires from the screw terminals and tagging them carefully Numbers 1 through 8 to correspond with the terminal numbers from which they were removed. From the schematic diagram it is apparent that the resistance of the lead wires will be added to the resistance of the motor windings and potentiometer strip in making the resistance checks as shown in Table 2.

To Check	Read Resistance	Between Terminals
½ Motor Winding	1.5 ohms	1-8
½ Motor Winding	1.5 ohms	1-4
½ Motor + Switch	1.5 ohms	1-5
½ Motor + Switch	1.5 ohms	1-6
Entire Motor	3.0 ohms	4-8
Right Limit Switch	0 ohms + leads	8-5
Left Limit Switch	0 ohms + leads	4-6
Entire Pot Strip	500 ohms	3-7
Pot Arm to + End	0 to 500 ohms	1-3
Pot Arm to - End	0 to 500 ohms plus leads	1-7

Table 2

Additional Check List

1. Check continuity of control wires for loose connections caused by wind.
2. Tape down control cable securely all the way to rotator.
3. Check motor winding through control cable as outlined in Table 2.
4. Check cable between leads. Static lightning charges or direct hits will cause carbon arcs in control cable at numerous spots along the cable that cannot be seen. This resistive path will break down with voltage applied to rotator. (Replace cable.)
5. Check both control and rotator terminal strips for shorts.
6. Rotation in one direction usually indicates a loose or broken cable wire, bad relay, and bad sensing transistors in some units.
7. Be sure cable is of proper size for length used. Refer to Table 1.
8. Substitute a 3 foot piece of new rotator cable to bench test unit. Proper operation will indicate a defective rotator cable on the mast or tower, or a cable not large enough to create proper turning torque.
9. Low line voltage and cold weather will slow rotation. Using an extra long or small wire extension cord can lower line voltage.
10. Sandpaper or wire brush the terminal strip. Rust causes high resistance causing control/rotator not to work properly.

Section IV. Disassembly of the Rotator

Disassembly of the Rotator

In order to service the rotator, the unit must be disassembled. We recommend the following procedure:

1. Remove the bottom mast support to permit the rotator to be set on a flat surface.
2. Remove four (4) screws and carefully raise the top casting to expose potentiometer and drive mechanism.
3. Carefully remove upper ball retaining ring. Keep it circular, and lay it on clean paper.
4. Inspect inside of top housing for small scratches or burned spots on the ribs. These are an indication that a switch blade or connection is rubbing during rotation. See that the pot strip is clean and not burned at either end. See that pot body is secure and that pot arm is clean at the point of contact. Use only fine rouge cloth to polish contact arm. Check limit switch to see if wires are secure and insulation is undamaged. Contacts should be clean. Check for 1/32" clearance between switch blades and motor — particularly alongside of lockwasher under motor fastening. Greater clearance gets switch too close to top bell housing ribs.

5. If the drive ring happens to be near end of rotation, operate the top spur gear to rotate the mechanical stop on the drive ring away from the area of the limit switch. See that the mechanical stop lever (which is the limit switch. See that the mechanical stop lever (which is positioned between the two limit switches) will open each electrical contact before it hits the corresponding mechanical stop. Also, see that the stop lever has not been deformed and that the electrical contacts are clean and uncorroded.
6. Rotate the top spur gear several revolutions to determine that the motor and its bearings are operating freely. Look for broken teeth in any of the gears.
7. Remove the drive ring gear from the base housing. This is accomplished by first pulling up on the side opposite the gear train. Then raise the entire ring slightly upward with the side away from the gear train higher so that it will slide out from under the gears. Examine closely for evidence of broken or worn teeth.
8. Examine the inside of the screw terminal strip to see that there is proper clearance between the solder lugs and frame and that there are no faults in the insulation. Pay particular attention to the insulation at the point where the wires are held in metal clips.
9. To remove potentiometer, remove hex nuts. Unsolder leads. Mounting studs are staked to the motor frame. Be sure that the potentiometer strip is clean and that the potentiometer arm is not corroded. Use only fine rouge cloth as an abrasive. In replacing the potentiometer be sure the connections are on the side which overhangs the motor.
10. To replace the motor, first remove the potentiometer per Step 9, then unsolder black motor lead if not done in Step 9, the red lead from the inside left limit switch lug, and the blue lead from inside the right limit switch lug. Fastenings holding motor on studs may then be removed and the motor pulled up and out. In replacing a motor, be sure to see that the round hole in the motor is next to the limit switch. Use special internal-external lockwasher over the stud that works in the slotted hole in the motor. Be sure that the pinion is snug against the spur gear before tightening this fastening over the slot.
11. When it is necessary to closely inspect or replace gears, it is possible to remove motor, limit switch, potentiometer, and terminal strip without unsoldering. Remove motor fastening from the mounting studs. Work motor up and out, exercising care in pulling leads and terminal strip through the window in the gear housing. Remove plate to expose gears. Carefully note position for proper replacement.

Section V. Re-Assembly of the Rotator

Re-Assembly

It is assumed in the following instructions that the motor and gear train along with the potentiometer and the limit switches are likewise assembled, wired and operative.

1. See that a small amount of low temperature, high quality, light weight grease is conservatively distributed around the ball bearings, ring gear and spur gears. Only an even film of grease is desirable (approximately one thimbleful of grease should be used to lubricate a completely dry rotator). Excessive grease will only run out at high temperatures or cause power loss at low temperatures.
2. Rotate the upper spur gear until the inwardly protruding mechanical stop on the ring gear touches the channel shaped stop lever and pushes it far enough to the left to just open the left hand limit switch contact (it is assumed that the rotator is viewed from the side of the limit switch). This situation represents the extreme clockwise end of rotation. The potentiometer arm must then be rotated to its extreme clockwise position against the top stop.
3. Secure the upper bell housing upside down by the mast support in a vise with the open end of the "V" toward the bench. The boss that drives the potentiometer arm, which is located in the bottom part of the housing, will then be to the left of center.
4. Clean the inner portion of the housing and apply a small amount of grease to the ball race. Then carefully insert one ball bearing assembly with the flanged rim up and against the outer edge of the casting.
5. Grasp the operating mechanism by the flat base, steady the ring gear, invert the mechanism and lower it into the housing. In doing this, note that the serrated portion of the potentiometer arm must engage the driving boss in the housing and that the three driving bosses on the ring gear must engage into the mating recesses in the top housing. This situation will result automatically if the previous instructions have been followed.
6. Clean the exposed bearing race and apply a film of grease. Then apply the top bearing assembly to the race with the rim downward.
7. Clean the retaining ring and apply a light film of grease to the ball race only. Lower the retaining ring into place so that the assembly holes will approximately line up with the threaded holes in the upper housing. Insert the four (4) assembly screws and use a heavy screwdriver to completely tighten the four (4) assembly screws. Torque to 85 inch-pounds.
8. It is suggested that all eight (8) wires be connected from the control box while the rotator is still on the bench and that its complete operation be checked.

Section VI. How to Get Factory Service

If service is required, the unit must be packed securely and sent prepaid to:

TELEX WARRANTY SERVICE CENTER, DEPT. 623
TELEX COMMUNICATIONS, INC./HY-GAIN DIVISION
8601 N.E. Highway 6
P.O. Box 5579
Lincoln, NE 68505 U.S.A.
Phone: (402) 467-5321

For units that are in warranty, no charge will be made for any repair work required. Include a copy of your sales receipt. For out-of-warranty units, call the Warranty Service Department for prices.

The price includes rebuilding the unit, replacing all defective and/or worn parts, and return freight charges. Hy-Gain reserves the right to change prices at its option. When returning items for repair, a check or money order for the repair charges must be included. Be sure to include your name, address, zip code, and telephone number. Also, give a brief description of the problem.

12-MONTH LIMITED WARRANTY

TELEX COMMUNICATIONS, INC. ("Telex") warrants to the user, who originally purchased the product, that the product will be free from defects in material and workmanship for the following periods after such date of purchase: Material, 12 months; Workmanship, 12 months. Telex will at its option repair or replace free of charge such defective products subject to the following conditions:

- 1) Delivery of the product or parts postage prepaid to Telex dealer, authorized service facility or factory.
- 2) Determination by Telex that a defect exists and is covered by limited warranty.
Defects due to alterations, repair by unauthorized person, insertion of non-Telex parts, misuse, accidental damage, use of the equipment for purposes other than those for which it was designed, and the like are not covered by this limited warranty and repairs thereof will be subject to normal service charges.
- 3) Repairs and replacement parts are covered under this limited warranty only for the unexpired term of the original limited warranty.
- 4) Products purchased from unauthorized dealers are not warranted.

All claims of defect or shortage should be sent postage prepaid to:

TELEX WARRANTY SERVICE CENTER, DEPT. 623
TELEX COMMUNICATIONS, INC./HY-GAIN DIVISION
8601 N.E. Highway 6
P.O. Box 5579
Lincoln, NE 68505 U.S.A./Phone: (402) 467-5321

VALID ONLY IN U.S.A.

THIS LIMITED WARRANTY IS EXPRESSLY IN LIEU OF ANY EXPRESS OR IMPLIED WARRANTY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE WHICH EXTENDS BEYOND THE TERM HEREOF. THE REMEDIES PROVIDED BY THIS LIMITED WARRANTY ARE THE ONLY REMEDIES AVAILABLE TO ANY PERSON. NO PERSON HAS ANY AUTHORITY TO BIND TELEX TO ANY REPRESENTATION OR WARRANTY OTHER THAN THOSE PROVIDED BY THIS LIMITED WARRANTY. TELEX SHALL NOT BE LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY FAILURE OR OTHERWISE OF THE PRODUCT.

Some states do not allow exclusions or limitations of incidental or consequential damages or limitations on how long an implied warranty lasts so the limitations or exclusions herein may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

IF YOUR UNIT IS DAMAGED, CONTACT YOUR DEALER OR THE SHIPPER. IF ANY OF THE ITEMS ARE MISSING, RETURN THE COMPLETE UNIT TO YOUR DEALER OR WRITE THE FACTORY FOR ASSISTANCE. A COPY OF YOUR SALES RECEIPT MUST ACCOMPANY ANY RETURN.

CHAPTER 3

PARTS LIST

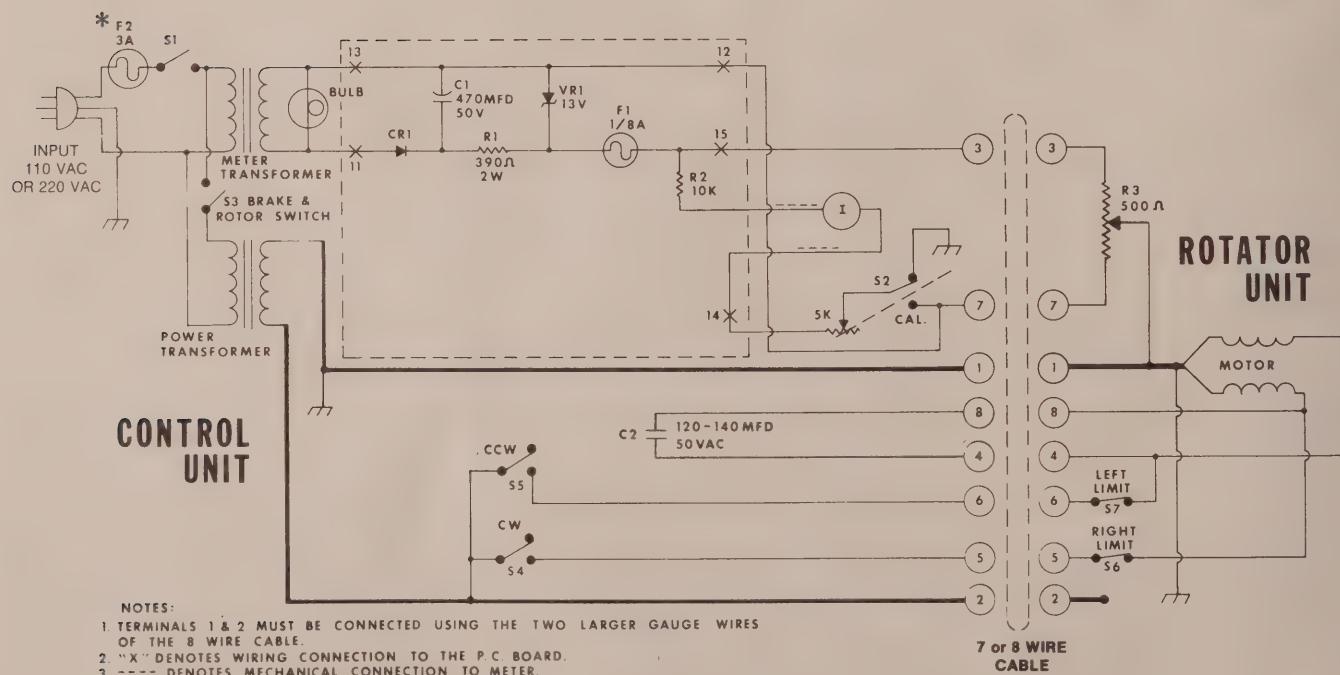
Control Unit — CD-45-II

Item No.	Part No.	Description	Qty
1		Control Unit, complete, 220 VAC	1
2	51568-10	Control Unit, complete, 120 VAC	1
3	51436-10	Printed Circuit Board Kit	1
3a		Capacitor, 470 MFD, C-1, 50V	1
3b		Resistor, 390 ohm, 2W, R-1	1
3c		Diode, Zener, VR-1	1
3d		Diode, CR-1	1
3e		Resistor, 10K ohm, 1/4W, R-2	1
3f		Fuse, 1/8 Amp, F-1	1
4	51437-10	Expandable Parts Kit (110V version)	1
4a		Fuse, 3 Amp, F-2	2
4b		Fuse, 1/8 Amp, F-1	2
4c		Bulb, meter	2
5	51437-20	Expandable Parts Kit (220V version)	1
5a		Fuse, 1 Amp, Slo-Blo, F-2	2
5b		Fuse, 1/8 Amp, F-1	2
5c		Bulb, meter	2
6	51438-10	Switch Kit, Brake/Direction	1
6a		Switch, S-3, S-4, S-5	3
7	51481-10	Cover Kit	1
7a		Cover, top	1
7b		Cover, bottom	1
7c		Skid Pads	4
7d		Screws	8
8	51482-10	Miscellaneous Hardware Kit (110V version)	1
8a		Knob, calibration	1
8b		Terminal Board (8 Terminals)	1
8c		Screws	2
8d		Lever, switch for S-3, S-4, S-5	3
8e		Strain Relief, cable and screw	1
9	51482-20	Miscellaneous Hardware Kit (220V version)	1
9a		Knob, calibration	1
9b		Terminal Board (8 Terminals)	1
9c		Screws	2
9d		Lever, switch for S-3, S-4, S-5	3
9e		Strain Relief, cable clip and screw	1
9f		Washer, backup	1
10	51449-10	Transformer Kit, Power, 220 VAC	1
11	51441-10	Transformer Kit, Power, 120 VAC	1
12	51450-10	Transformer Kit, Meter, 220 VAC	1
13	51442-10	Transformer Kit, Meter, 120 VAC	1
14	51172-10	Capacitor, Motor Start Kit	1
15	50861-10	Line Cord Kit, 3-Wire, 120 VAC	1
16	50798-00	Line Cord Kit, 3-Wire, 220 VAC (European plug)	1
17	51499-10	Meter Kit	1
17a		Meter	1
17b		Bezel	1
17c		Mounting Hardware	1

Control Unit — CD-45-II (cont.)

Item No.	Part No.	Description	Qty
18	51776-10	Switch Kit, On/Off, S-1	1
19	51445-10	Switch Kit, Calibration, S-2	1
20	51446-10	Fuse Holder Kit (for F-2) (110V version)	1
21	51446-20	Fuse Holder Kit (for F-2) (220V version)	1
22	51570-10	Face Plate Kit	1
23	51448-10	Chassis Kit (110V version)	1
24	51448-20	Chassis Kit (220V version)	1
25	51439-20	Grounding Lug Kit (220V version)	1
25a		Wing Nut, $\frac{1}{4}$ "-20	1
25b		Nut, hex, $\frac{1}{4}$ "-20	1
25c		Lockwasher, internal, $\frac{1}{4}$ "	2
25d		Flatwasher, $\frac{1}{4}$ "	2
25e		Bolt, $\frac{1}{4}$ "-20 x $\frac{3}{4}$ "	1

Hy-Gain reserves the right to change prices at its option. Current prices may be obtained by calling or writing the factory. Please send a stamped, self-addressed envelope.



*(F-2 — 3A Fuse, 110V/1A Slo-Blo, 220V)

Figure 9
Schematic

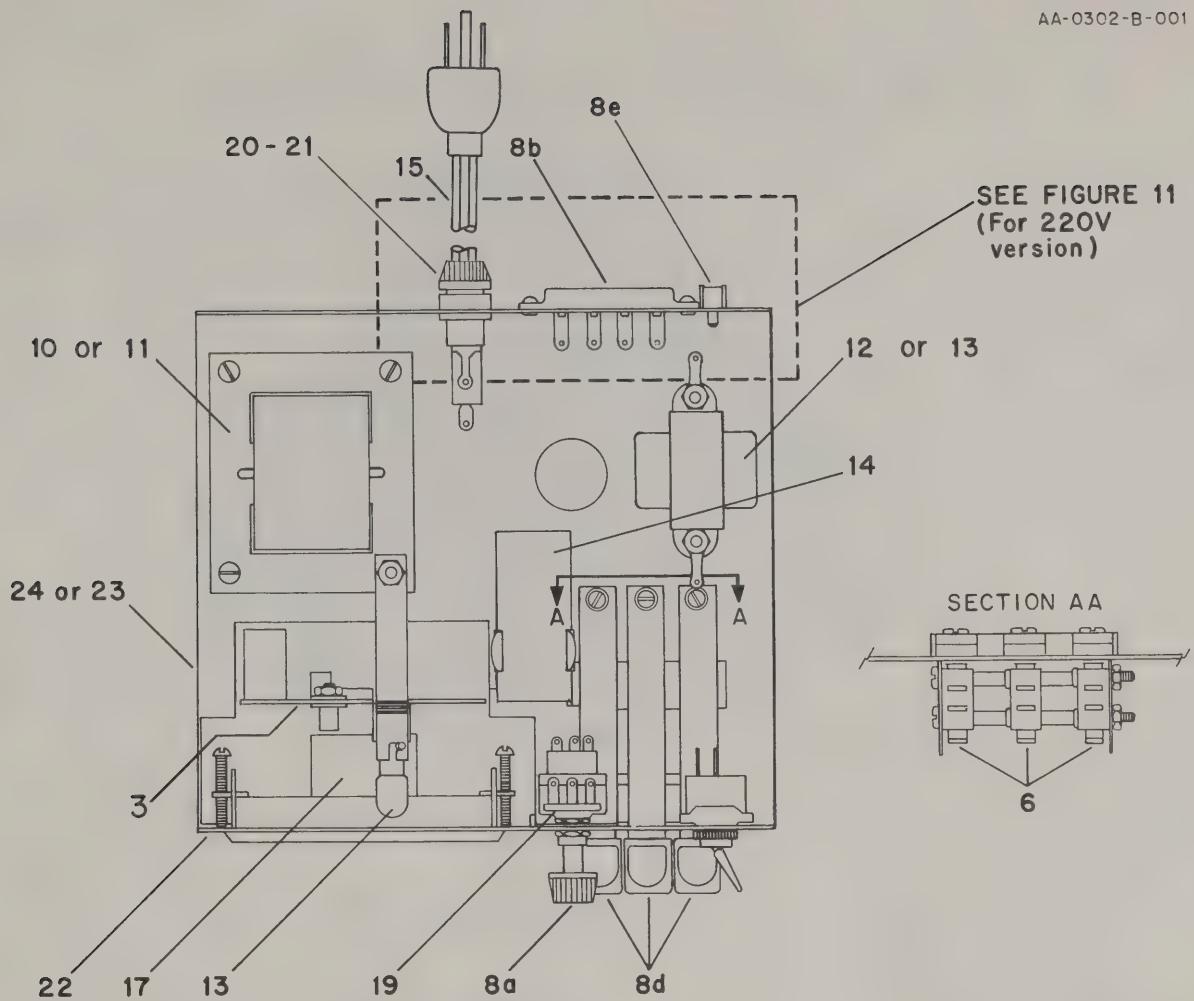


Figure 10
Control Unit — Top View

AA-0302-C-012

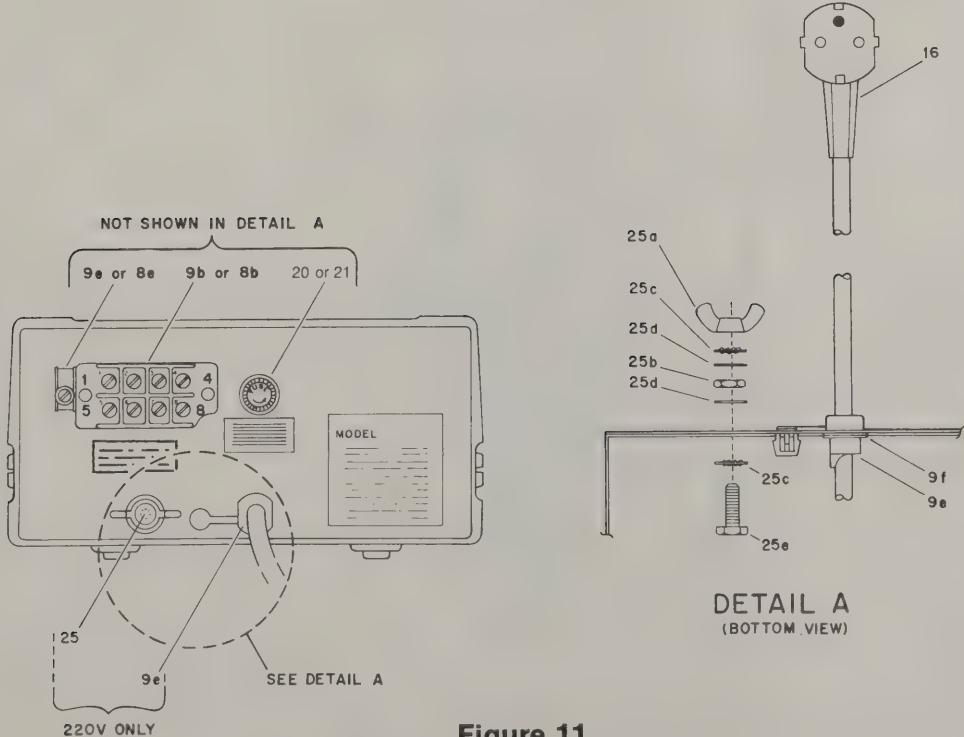


Figure 11
Control Unit — Back View

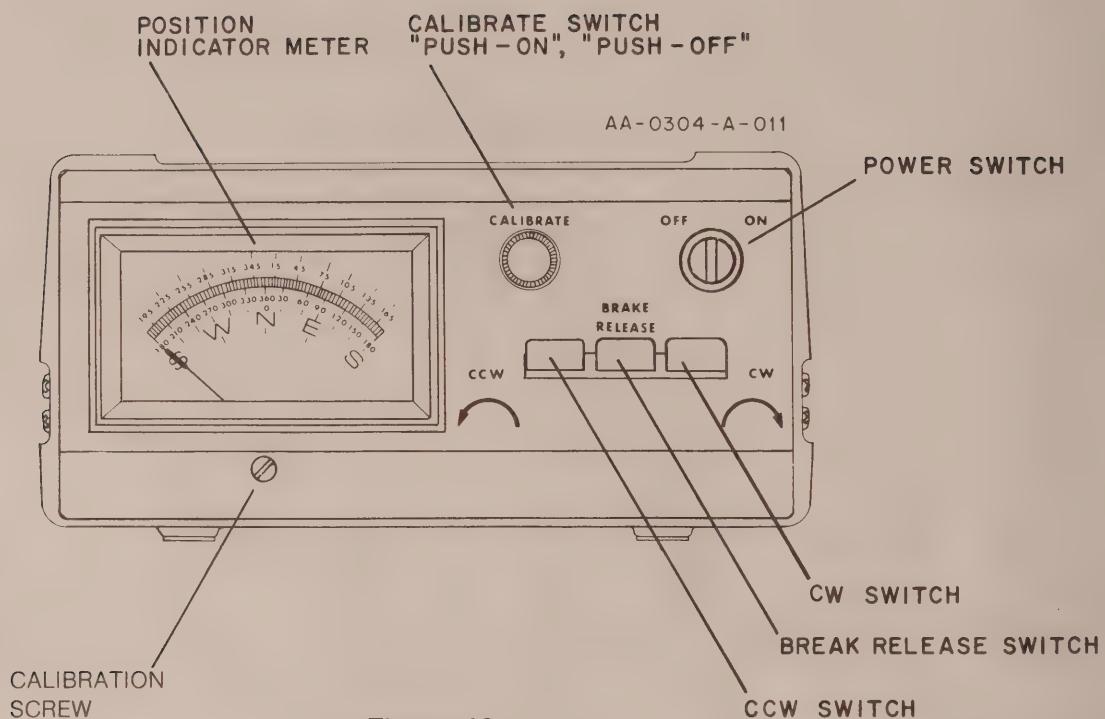


Figure 12
Control Unit — Front Panel

CD-45-II Rotator

Item No.	Part No.	Description	Qty
26	51571-10	Rotator, Complete E/W Hardware	1
27	50304-10	Upper Mast Support Kit	1
28	51310-10	Ball Bearing Kit..... Ball Bearings..... Bearing Retainer	2 49 1
29	50422-10	Spur Gear Kit	1
		Assembled Gears (short pinion) Upper 3	3
		Assembled Gear (large pinion) Upper Left	1
		Stacked Spur Gears (Lower Right)..... Spacers & Washers.....	3 5
30	50370-10	Base Casting and Gear Shaft Assembly Kit	1
31	51459-10	Motor Mounting Plate Assembly Kit	1
32	51471-10	Motor and Pinion Kit	1
33	51460-10	Potentiometer Kit, Sensor	1
34	51461-10	End of Rotation Switch Assembly Kit	1
35	50349-10	Lower Mast Support Kit	1
36	51465-10	Terminal Board Kit (8 Terminals)	1
		Terminal Board..... Screws	1 2
37	51466-10	Hex Head Screw Kit	1
		Screw, hex head (Taptite), #12-24 x 3/4"	4
38	50424-10	Bearing Race Kit	1
39	50313-10	Ring Gear Kit	1
40	50423-10	Stop Arm Kit	1
41	50425-10	Mounting Hardware Kit	1
42	51497-10	Grease Kit	1

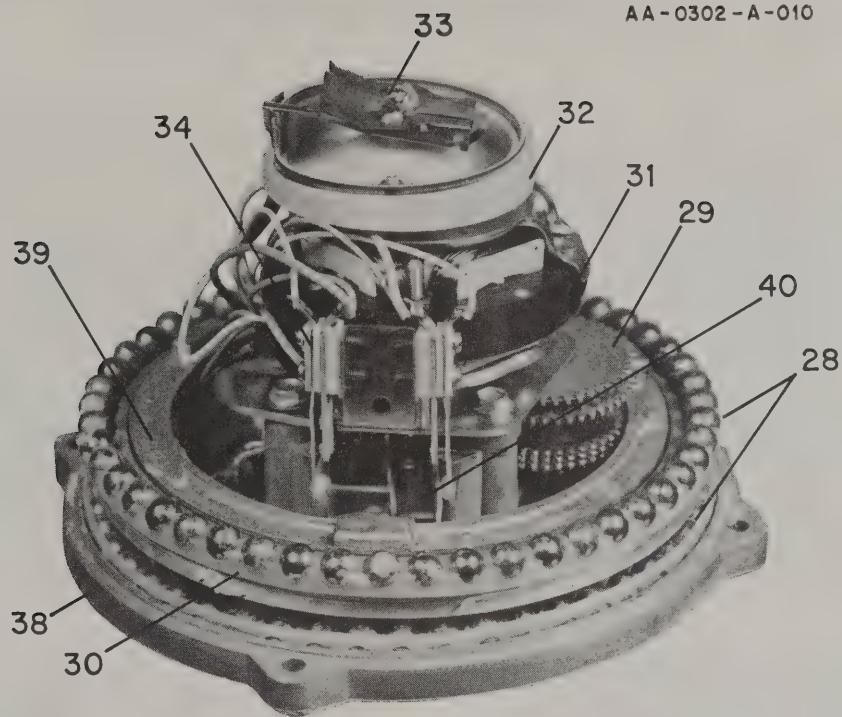


Figure 13
Rotator Unit — Interior View

AA-0302-A-011

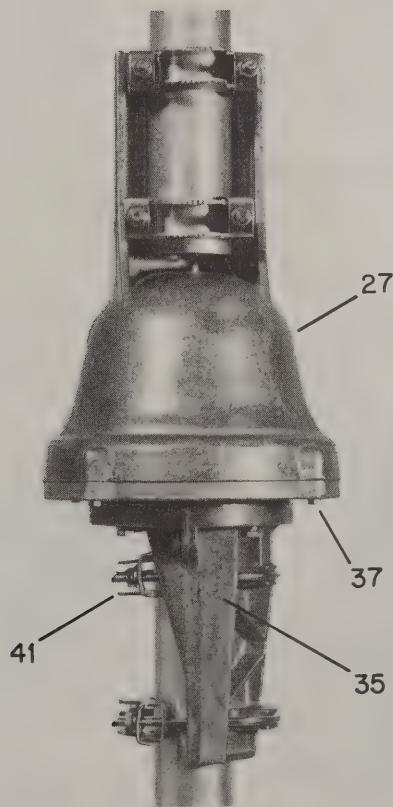
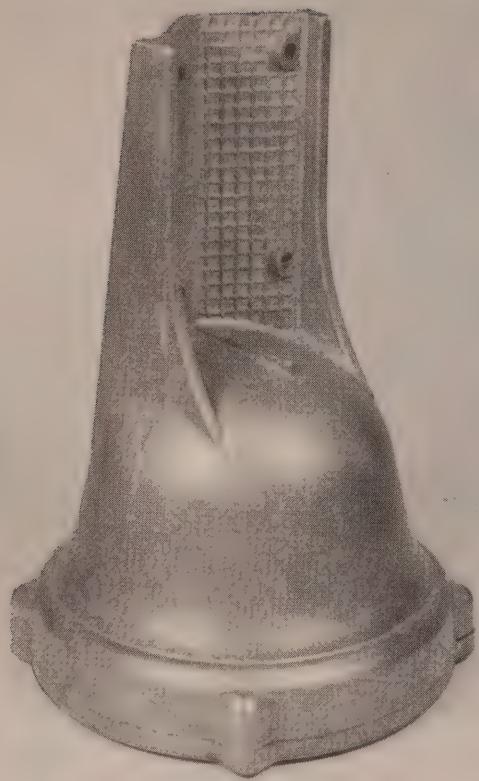


Figure 14
Rotator with Support Bracket

CD-45-II ROTATOR ASSEMBLY

AA-0305-A-013

AA-0305-A-014

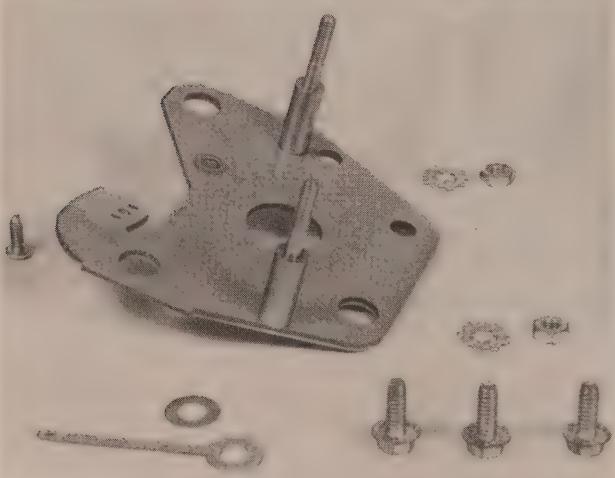


27 — UPPER MAST SUPPORT — 50304-10



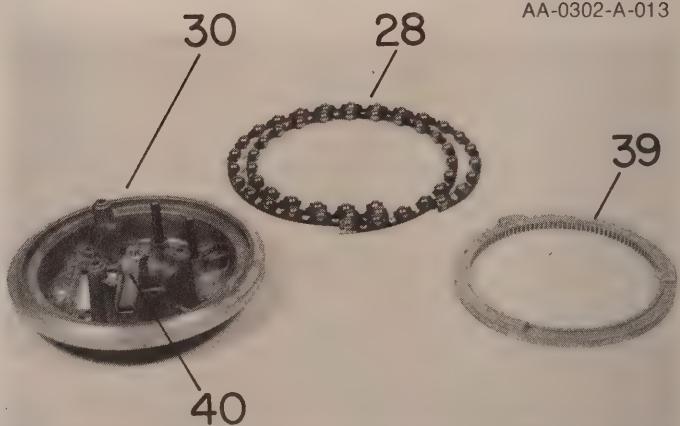
35 — MAST SUPPORT KIT — 50349-10

AA-0305-A-015



31 — MOTOR MOUNT PLATE KIT — 51459-10

AA-0302-A-013

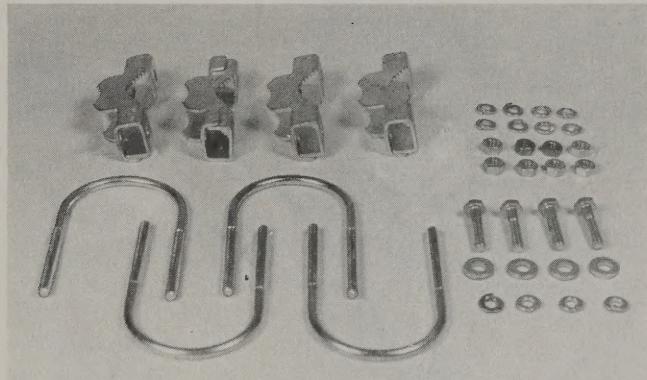
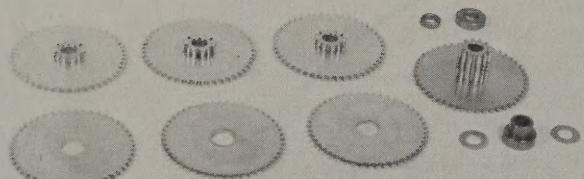


28 — BALL BEARING KIT — 51310-10
30 — BASE INCLUDING POSTS — 50370-10
39 — RING GEAR — 50313-10
40 — STOP ARM KIT — 50423-10

CD-45-II ROTATOR ASSEMBLY

AA-0305-A-017

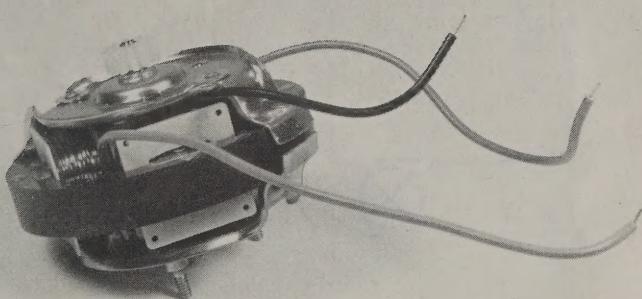
AA-0305-A-018



29 — SPUR GEAR KIT — 50422-10

41 — MOUNTING HARDWARE KIT — 50425-10

AA-0305-A-019



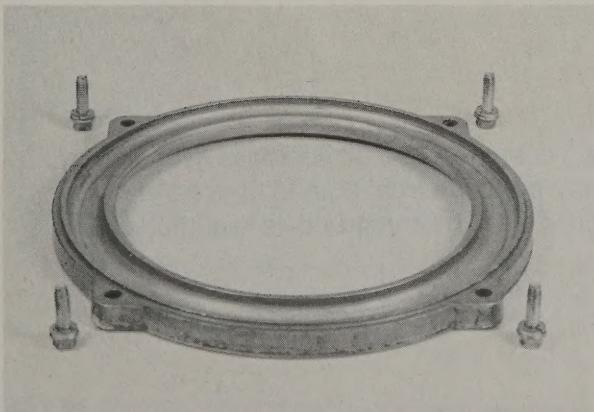
42 — GREASE KIT — 51497-10

(Not Pictured)

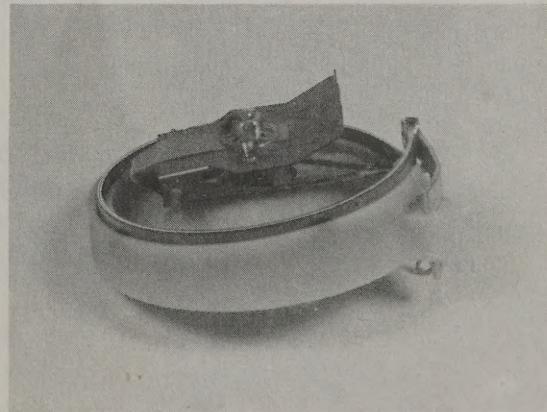
32 — MOTOR ASSEMBLY KIT — 51471-10

AA-0305-A-020

AA-0305-A-021

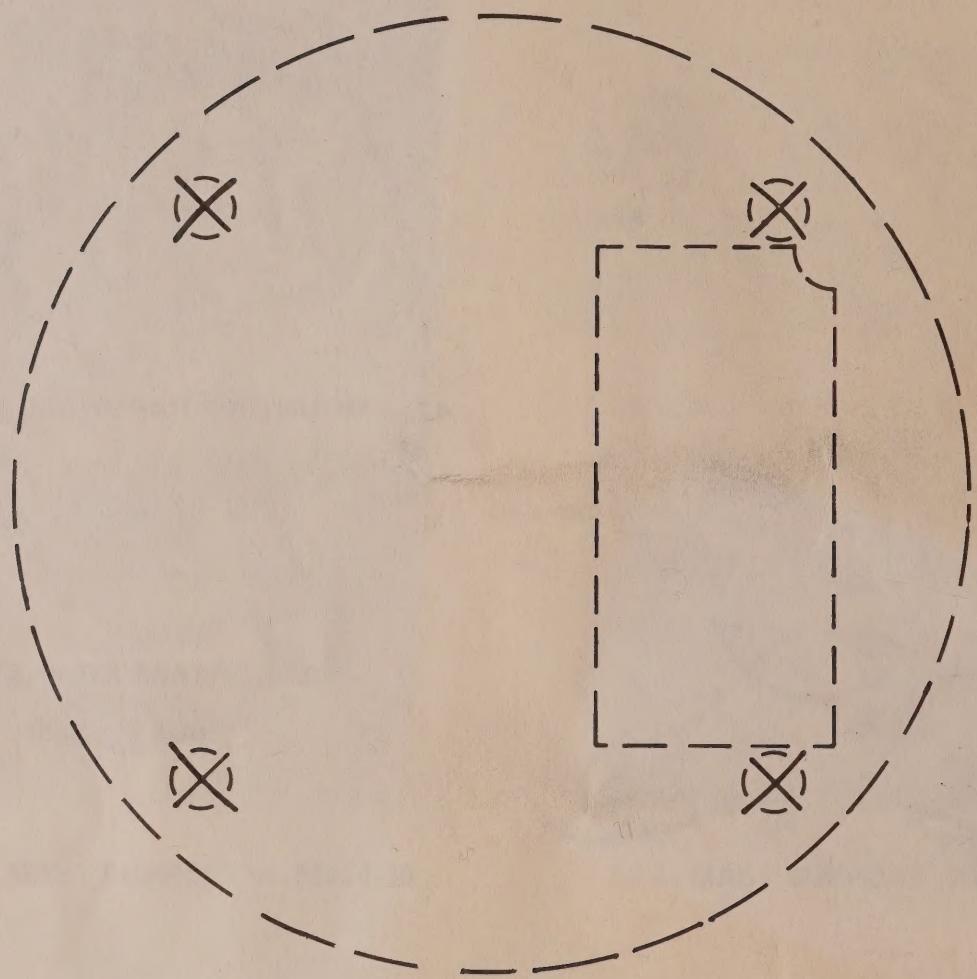


38 — BEARING RACE KIT — 50424-10



33 — POTENTIOMETER KIT — 51460-10

HOLES TO BE 17/64 CLEARANCE DRILL



TOWER DRILLING TEMPLATE

This information is believed correct, but no warranty is given or implied and no liability is assumed by Hy-Gain as to its accuracy or completeness. Changes may be made from time to time so the user should verify all factors that may be critical. This information is not to be construed as to authorizing or advising use of any patented invention.

TELEX *hy-gain*[®]

TELEX COMMUNICATIONS, INC.

9600 ALDRICH AVE. SO., MINNEAPOLIS, MN 55420 U.S.A.